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## A CASE OF INFECTION OF LYMPH GLANDS WITH BACILLUS PARATYPHOSUS B\*

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The patient, a private in the United States Army, presented symptoms suggestive of Hodgkin's disease, and his case was at first so diagnosed and reported.

In March, 1914, the patient noticed, on a march, that the left leg was becoming "numb" and swollen. Two months later the glands in the left side of the neck were enlarged. He had not suffered any pain. On admission to hospital, June 21, 1914, he still complained of swelling and numbness in the left leg and thigh.

The general physical condition and nutrition of the patient were good. He was 70½ inches in height, and 139 pounds in weight. His skin was relaxed and showed no pigmentation. The mucous membranes were pale. Eyes, ears, and nose showed no significant abnormalities; the teeth were fairly good, but poorly cared for.

The cervical glands on the right side, both superficial and deep, were hard and slightly movable. There was a slight infiltration of the surrounding tissue. The skin was not adherent to the glands. On the left side of the neck there was a large mass, hard, discrete, and movable. Pain developed in the glands on the left side of the neck, where there was some redness of the skin. Incision was made and pus drained.

Aside from increased resonance in the left infra-clavicular region and a few moist râles in the left side of the chest, the lungs and chest were normal and the sputum negative.

The heart and blood vessels were normal. The systolic blood pressure was 135; the diastolic, 70; pulse pressure, 65; pulse rate, 85. There was a slight dilatation of the superficial veins of the abdomen.

In the left lower abdomen there was a large, hard, and slightly movable mass. The left internal iliac glands were enlarged, hard, and movable.

The left leg at the thigh was 1½ inches larger than the right; at the middle of the calf, 1 inch larger than the right. Edematous swelling was present, as a result probably of pressure by the enlarged iliac glands on the left iliac vessels. The axillary glands on both sides were enlarged, hard, and movable. There was no evidence of obstruction in the upper extremities.

The feces were negative. The urine showed a specific gravity of 1.008; hyaline and granular casts, and epithelial cells, squamous and round; genito-urinary system otherwise normal. The blood showed 4,300,000 red cells, 10,400 white cells, hemoglobin 73%, small mononuclears 46.75%, large mononuclears

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14.75%, transitional 0.50, neutrophils 37.75%, mastcells 0.25%. Wassermann and luetin tests negative.

Temperature varied from 97.2 to 104.4.

In October, 1914, the patient began to complain of increasing pain in the left shoulder and the left arm. There were marked sensitiveness and redness over a mass on the left infra-clavicular space. A movable gland was excised and examined. Macroscopically there were evident small white nodes throughout the tissue. Sections revealed a uniform distribution of small round cells, regular in size, with also a few large cells. In some areas the cells were more closely crowded without increase of connective tissue. In a few small areas the cells were arranged in well-separated columns bounded by a connective tissue framework; these cells had no regular order and no apparent relation to the other cells. There was a distinct capsule limiting the gland.

From the pus, removed with a syringe from the suppurating gland in the neck, a short motile gram-negative bacillus was isolated. Cultures of this organism in agar yielded bluish-white colonies after 24 hours; in Loeffler's blood serum, a white distinct growth, with, at the end of 72 hours, a black line at water of condensation; blood agar gave a white growth which was more profuse than that on any other media. Cultures in Dunham's solution showed general cloudiness, slightly increased after 48 hours; no indol was produced. Nitrates were not reduced in 90 hours. In litmus milk the organism caused slight acidity and gave rise to a blue-green cream ring after 24 hours; after 48 hours the acidity had been increased, and the green cream ring was marked; at the end of 72 hours changes to white were discernible at the butt. On potato the bacillus gave a moist white growth after 24 hours, less moist at the end of 72 hours. In Russell's double sugar there was an acid butt, blue stem, and formation of gas at the end of 24 hours; after 48 hours, the blue color was marked and gas-formation still evident; and after 72 hours the medium was entirely blue except for the decolorized butt.

Table 1 shows the fermentative reactions of the bacillus on various sugars.

FERMENTATIVE REACTIONS OF THE BACILLUS ISOLATED ON VARIOUS SUGARS

Media	Fermentative Reaction After			
	24 Hr.	48 Hr.	72 Hr.	72 Hr.
Glucose.....	40 %	40 %	42.5%	Acid
Levulose.....	42.5%	45 %	47.5%	Acid
Galactose.....	45 %	45 %	45 %	Acid
Mannite.....	60 %	57.5%	55 %	Acid
Maltose.....	25 %	45 %	50 %	Acid
Lactose.....	No gas	No gas	No gas	Alkaline
Saccharose.....	No gas	No gas	No gas	Alkaline
Dextrose.....	Bubble; no gas	No change	No change	Alkaline
Starch.....	No change	No change	No change	Alkaline
Dulcitol.....	70%	82.5%	85%	Acid
Raffinose.....	No gas	No gas	No gas	Alkaline

The organism failed to liquefy gelatin in 5 days.

The organism was agglutinated by *B. paratyphosus* B immune serum in dilution of 1:640. A known paratyphoid bacillus, used as control, was agglutinated by the immune serum in dilution of 1:5120. The blood serum of the patient failed to agglutinate the organism in dilutions of from 1:20 to 1:5120,

and failed to agglutinate the known paratyphoid bacillus in all dilutions. Subcultures of the organism were further identified as *B. paratyphosus* B in the laboratory of the Army Medical School at Washington, D. C.

#### INOCULATION EXPERIMENT

The pus was injected subcutaneously into the abdomen of a guinea-pig. An extensive area of induration followed, gradually extending under the skin of the abdomen and the thorax to dimensions of 1 by 2½ inches. From the clear serous exudate, drawn with a syringe, an organism was isolated in pure culture, corresponding in all its characteristics to *B. paratyphosus* B.

Thirteen days after inoculation the guinea-pig died. The indurated area was one-fourth inch thick, friable, yellow-white in color. No pus was present. The vessels of the abdomen, chest wall, and mesentery were congested. The lymph nodes of the intestine and the mesenteric glands were enlarged and congested. The spleen was markedly enlarged.

In the microscopic examination there was revealed an infiltration of the tissue with small round cells that almost completely destroyed the normal structures. Some of the blood vessels in the indurated tissue remained patulous and some of the muscle bundles were surrounded by varying areas of inflammatory product. The infiltrate toward the margin of the indurated area lay largely in the areolar tissue below the superficial muscular layers, and extended between the muscle bundles by way of the epimysium. The cells in the indurated area varied from large with abundant cytoplasm and distinct nuclei to small with small nuclei and little or no cytoplasm.

The spleen showed marked degeneration. There were areas irregularly placed showing no structure, the intervening areas being filled with large and small cells, like those in the inflamed tissue at the site of the injection. In these cells the nuclei were irregular as to size and shape, some apparently budding forms being seen. Especially notable were numerous cells with abundant cytoplasm and small round deeply staining nuclei; and other cells with much cytoplasm and large poorly staining nuclei.

Numerous enlarged glands were removed from the mesentery, one, after hardening, measuring 4 by 2 mm. The connective tissue in this gland stained poorly. The cellular elements appeared closely approximated with little connective tissue support. The regularity of the cells and their nuclei were marked throughout the gland. There were a few large cells with nuclei, but no diminutive or degenerated cells. There were numerous large lacunae filled with a poorly staining homogeneous material, with a slight crowding of cells around the lacunar periphery.

In the liver the vessels around the central veins were greatly distended and congested. Around the larger veins were areas of cell-destruction, showing the presence of foreign cells.

In the kidney there was cloudy swelling of the cells of the tubules with partial occlusion of the lumen; the cells remained in situ against the basement membrane and no inflammatory localizations or abscesses were found. Cells of the glomeruli showed cloudy swelling. A few blood vessels were dilated with blood elements. The proportion of mononuclear white cells as compared with that of polymorphonuclears was high.

Subcultures of each of the organisms isolated from the guinea-pig lesion and heart blood were identified as cultures of *B. paratyphosus* B at the laboratory of the Army Medical School at Washington, D. C.

There were no agglutinins present in the blood of the patient for either a known culture of *B. paratyphosus* B or the organism isolated. After treatment with an antogenous vaccine from April 20 to May 4, 1915, the patient clinically showed some improvement at the time of his discharge, on May 19, but there were still no agglutinins present in the patient's blood when last taken (May 10).

Cultures from blood, urine, and feces were negative for the presence of *B. paratyphosus* B.

Subsequent to the identification of the organism efforts were made to elicit a history of typhoid or any febrile condition at any previous time in the patient's life; but no such history could be obtained.

During a long period of observation the organism produced suppuration in one group of glands on two occasions, more than a month after surgical intervention; other greatly enlarged glands did not suppurate. Interference with the blood supply to still other glands or parts of glands appears to have aided suppuration. On inoculation of an animal with pus from the broken-down glands, death resulted before local necrosis had progressed to the stage of pus-formation, while but slight evidence of such existed in the tissues.

This case of multiple lymphadenitis may be added to the list of localized infections by this type of organism which manifest themselves as primary infections. These, as given by Park and Williams, are as follows: "Pyelitis (sometimes associated with septicemia), cystitis, arthritis, periostitis, phlebitis, cholecystitis, etc. It occasionally occurs as a complicating infection of other diseases."

#### CONCLUSION

The condition of multiple lymphadenitis described in this patient seems to have been caused by an infection with *Bacillus paratyphosus* B, and, so far as could be ascertained, the disease developed without a preliminary manifestation of a typhoid-like, gastro-enteric, or cholera-like type of infection.